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APPLICATION NUMBER: *60/458,987*
FILING DATE: *March 28, 2003*
RELATED PCT APPLICATION NUMBER: *PCT/US04/09436*

By Authority of the
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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c).

INVENTOR(S)

Given Name (first and middle [if any])	Family Name or Surname	Residence (City and either State or Foreign Country)
Frantz	Stanford	Madison, Wisconsin

☐ *Additional inventors are being named on the ___ separately numbered sheets attached hereto*

TITLE OF THE INVENTION (280 characters max)

MECHANICAL LIFT MEASUREMENT SYSTEM

Direct all correspondence to: **CORRESPONDENCE ADDRESS**

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ENCLOSED APPLICATION PARTS *(check all that apply)*

☑ Specification *Number of Pages* 11
☑ Drawing(s) *Number of Sheets* 2
☐ Application Data Sheet. See 37 CFR 1.76
☐ CD(s), Number
☑ Other (specify) Return Postcard

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT

☐ Applicant claims small entity status. See 37 CFR 1.27.
☐ A check or money order is enclosed to cover the filing fees
☑ The Commissioner is hereby authorized to charge filing fees or credit any overpayment to Deposit Account Number: 17-0055
☐ Payment by credit card. Form PTO-2038 is attached.

FILING FEE AMOUNT ($): $160.00

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.
☑ No.
☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____

Respectfully submitted,

SIGNATURE Adam J. Forman
Date 3 / 28 / 03
TYPED or PRINTED NAME Adam J. Forman
REGISTRATION NO. *(if appropriate)* 46,707
TELEPHONE 414.277.5405
Docket Number: 130324.98149

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51. The information is used by the public to file (and by the PTO to process) a provisional application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the complete provisional application to the PTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, Washington, D.C. 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Box Provisional Application, Assistant Commissioner for Patents, Washington, D.C. 20231.

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☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 160.00

Complete if Known	
Application Number	
Filing Date	
First Named Inventor	Frantz Stanford
Examiner Name	
Group Art Unit	
Attorney Docket No.	130324.98149

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FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1001	750	2001	375	Utility filing fee	
1002	330	2002	165	Design filing fee	
1003	520	2003	260	Plant filing fee	
1004	750	2004	375	Reissue filing fee	
1005	160	2005	80	Provisional filing fee	160.00

SUBTOTAL (1) ($) 160.00

2. EXTRA CLAIM FEES FOR UTILITY AND REISSUE

		Extra Claims		Fee from below	Fee Paid
Total Claims	-20** =		x		= 0.00
Independent Claims	-3** =		x		= 0.00
Multiple Dependent					=

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
1202	18	2202	9	Claims in excess of 20
1201	84	2201	42	Independent claims in excess of 3
1203	280	2203	140	Multiple dependent claim, if not paid
1204	84	2204	42	** Reissue independent claims over original patent
1205	18	2205	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0.00

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
1051	130	2051	65	Surcharge - late filing fee or oath	
1052	50	2052	25	Surcharge - late provisional filing fee or cover sheet	
1053	130	1053	130	Non-English specification	
1812	2,520	1812	2,520	For filing a request for *ex parte* reexamination	
1804	920*	1804	920*	Requesting publication of SIR prior to Examiner action	
1805	1,840*	1805	1,840*	Requesting publication of SIR after Examiner action	
1251	110	2251	55	Extension for reply within first month	
1252	410	2252	205	Extension for reply within second month	
1253	930	2253	465	Extension for reply within third month	
1254	1,450	2254	725	Extension for reply within fourth month	
1255	1,970	2255	985	Extension for reply within fifth month	
1401	320	2401	160	Notice of Appeal	
1402	320	2402	160	Filing a brief in support of an appeal	
1403	280	2403	140	Request for oral hearing	
1451	1,510	1451	1,510	Petition to institute a public use proceeding	
1452	110	2452	55	Petition to revive - unavoidable	
1453	1,300	2453	650	Petition to revive - unintentional	
1501	1,300	2501	650	Utility issue fee (or reissue)	
1502	470	2502	235	Design issue fee	
1503	630	2503	315	Plant issue fee	
1460	130	1460	130	Petitions to the Commissioner	
1807	50	1807	50	Processing fee under 37 CFR 1.17(q)	
1806	180	1806	180	Submission of Information Disclosure Stmt	
8021	40	8021	40	Recording each patent assignment per property (times number of properties)	
1809	750	2809	375	Filing a submission after final rejection (37 CFR § 1.129(a))	
1810	750	2810	375	For each additional invention to be examined (37 CFR § 1.129(b))	
1801	750	2801	375	Request for Continued Examination (RCE)	
1802	900	1802	900	Request for expedited examination of a design application	

Other fee (specify) _____

*Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 0.00

SUBMITTED BY

Name (Print/Typo)	Adam J. Forman	Registration No. (Attorney/Agent)	46,707	Telephone	414.277.5405
Signature	Adam J. Forman			Date	March 28, 2003

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EXPRESS MAIL NO.

Docket No. 130324.98149

PATENT APPLICATION FOR

MECHANICAL LIFT MEASUREMENT SYSTEM

by

Frantz Stanford

MECHANICAL LIFT MEASUREMENT SYSTEM

CROSS-REFERENCE TO RELATED APPLICATIONS

--

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

--

BACKGROUND OF THE INVENTION

[0001] The present invention relates generally to mechanical lift systems, and in particular, relates to a method and apparatus for measuring the orientation of a load whose position is controlled using lift operations.

[0002] Conventional lifting systems include a plurality of hydraulic actuators having cylinders and movable pistons acting under high fluid pressure that support the underside of a load. In some cases, for example when the load is bulky, heavy, or has an uneven weight distribution, the user must take special care to ensure that the load does not slide off its supports. In these cases, it is desirable to implement a system that provides feedback regarding the orientation of the load (e.g., level with respect to the horizontal plane). If it is determined that the load is not level, certain hydraulic actuators may be selectively adjusted until the measured load orientation substantially equals the desired load orientation.

[0003] Conventional computerized measurement systems include a plurality of sensors that are mounted at select locations on the load that send electronic feedback to a centralized processor that monitors the relative position of each sensor and determines whether the load is properly orientated. Alternatively, the sensors may be placed directly on the actuators to measure the amount of piston displacement. The measured load orientation is fed through an electronic communications system and output to a user display. The user may then choose to raise or lower certain cylinders to place the load in its desired orientation. Some computerized systems have the capability to accept a desired orientation as input by the user, and constantly monitor and automatically adjust the position of those cylinders necessary to achieve the desired orientation.

[0004] While such systems possess considerable capability and ease of operation, they are expensive and complex to implement, especially when installing the computerized system from one load to the next.

[0005] What is therefore needed is a method and apparatus for determining the actual orientation of a load that is simplified and cost effective compared to conventional computerized lift measurement systems.

BRIEF SUMMARY OF THE INVENTION

[0006] In accordance with one aspect of the invention, a lift measurement system is provided for determining a position of a load during a lift operation. The system includes a housing that defines a scale and encloses a movable indicator that moves relative to the scale and is aligned with the scale. A mechanical linkage is in communication with the load and the indicator, such that movement of the load is translated to movement of the indicator relative to the scale to provide an indication of the position of the load.

[0007] These and other aspects of the invention are not intended to define the scope of the invention for which purpose claims are provided. In the following description, reference is made to the accompanying drawings, which form a part hereof, and in which there is shown by way of illustration, and not limitation, a preferred embodiment of the invention. Such embodiment also does not define the scope of the invention, and reference must therefore be made to the claims for this purpose.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Reference is hereby made to the drawings in which like reference numerals correspond to like elements throughout, and in which:

[0009] Fig. 1 is a perspective view of a mechanical lift measurement system constructed in accordance with a preferred embodiment of the invention;

[0010] Fig. 2 is a sectional elevation view of the cable assembly illustrated in Fig. 1 and taken along line 2-2 of Fig. 1; and

[0011] Fig. 3 is a sectional side elevation view of the display illustrated in Fig. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0012] Referring to Fig. 1, a load 12 is provided that, for example, may have a flat rectangular base 11 that defines four quadrants A-D corresponding to the four corners of the base. Base 11 extends in a horizontal plane when load 12 is in its optimal

orientation. A mechanical lift measurement system 10 is provided for measuring the orientation of the load 12 whose vertical position is controlled using a lift operation. In particular, load 12 is supported and lifted by a plurality of hydraulic actuators 14A-14D having corresponding cylinders 16 and movable pistons 18 that extend upwardly from the cylinders 16. Pistons 18 define upper surfaces 20 that support the lower surface 11 of load 12, and extend and contract under forces provided by a hydraulic fluid under high pressure. This is a simplified set up which is provided for illustrative purposes. The invention could be applied to many and varied lifting applications, such as lifting houses, other buildings, bridges, and other structures.

[0013] In particular, when load 12 is to be raised, a switch (not shown) is actuated by the user to activate a pump (not shown) that causes hydraulic fluid to flow from a tank (not shown) to the cylinders 16 via supply lines 20. The hydraulic pressure acts on the undersurface (not shown) of pistons 18 and causes the pistons 18 to extend upwardly with respect to the corresponding cylinders 16. Conversely, when load 12 is to be lowered, fluid flows from cylinders 16 to the tank via return lines 22 which causes the pistons 18 to contract under gravitational forces of the load 12.

[0014] While quadrants A-D correspond with the four corners of the rectangular base 11 in accordance with the preferred embodiment, actuators 14A-D may be positioned at any location with respect to the base so as to fully support the load 12, enable a determination of the orientation of load 12, and enable corrective measures to return the load 12 to its desired orientation when it is determined that load 12 is unbalanced. Actuators 14 may be controlled simultaneously using a single valve, orifice, or switch, and may be controlled using individual valves, orifices, or switches in accordance with the preferred embodiment. While four such hydraulic actuators 14 support load 12 as illustrated in Fig. 1, the present invention anticipates that any number of actuators 14 may support a given load 12.

[0015] In accordance with the preferred embodiment, mechanical lift measurement system 10 includes a plurality of mechanical linkages 24A-D that are disposed proximal corresponding actuators 14A-D. A corresponding plurality of cable assemblies 28 define proximal ends 29 that are connected to each mechanical linkage 24, and distal ends 31 that are connected to each of a corresponding plurality of displays 26A-D. Displays 26 are thus located remotely from the corresponding linkage 24 depending on the length of corresponding cable assembly 28. Displays 26 are all preferably disposed proximal each other in a given remote display zone 25 to facilitate ease of operation. Each display 26

includes an indicator 27 that is connected to one of the cable assemblies 28. Accordingly, movement of load 12 at a given quadrant translates the corresponding mechanical linkage 24, which in turn actuates cable assembly to bias the indicator 27, thus providing a visual indication of the vertical position of the corresponding quadrant of load 12. The preferred embodiment will now be described with reference to actuator 12A, it being appreciated that the method and apparatus for determining the relative vertical position of load 12 proximal the remaining actuators 12B-D at corresponding quadrants B-D is the same as that for actuator 12A.

[0016] The term "relative orientation" is used herein to define a position of load 12 proximal one of the actuators 14A relative to the position of load 12 proximal one or all of the remaining actuators 14B-D. Because actuators 14A-D as used in accordance with the preferred embodiment raise and lower load 12, the term "position" as used herein is with respect to the vertical direction and the term "orientation" is used with respect to the horizontal plane. It should be appreciated that for loads having an irregularly shaped base 11, the load may not be optimally orientated when pistons 18 are positioned coplanar with respect to each other. Rather, the optimal position of the pistons 18 depends on the position of load 12 at quadrants A-D that provide optimal load stability. Therefore, the term "desired orientation," while horizontal in accordance with the preferred embodiment, is broadly construed to include any orientation that produces improved stability of load 12 during lifting operations.

[0017] Mechanical linkage 24A includes an anchor 30 whose upper surface is mounted onto base 11 at quadrant A using any known suitable fastening technique, e.g., adhesive, screws, nails, etc... The center of lower surface of anchor 30 defines a mounting location 32. A bracket 34 is fixed to cylinder 16A using any suitable fastening technique, and extends horizontally outwardly therefrom. Bracket 34 defines a cylindrical bore 36 that extends vertically through the center of bracket 34 and is in vertical alignment with mounting location 32. Cable assembly 28 includes a tubular metal cable member 38 that is surrounded by a tubular flexible plastic or rubber-covered wound metal outer sleeve 40, as illustrated in Fig. 2. The type of cable assembly used may be the type of cable used for aircraft controls, which is a heavy duty version of the type of cable/sleeve used for bicycle brakes and gear shifting cables. The sleeve 40 is incompressible and inextensible axially, and the steel cable 38 is also inextensible and incompressible and supported against buckling by sleeve 40. Bore 36 may be threaded so as to be attached to a threaded end of the sleeve 40, or there may be a press fit or any other suitable

connection between the end of the sleeve 40 and the bracket 34 to prevent relative axial movement. The proximal end of cable member 38 extends outwardly from sleeve 40 and vertically upwardly through bore 36, and is fastened to the mounting location 32 of anchor 30. It should be appreciated that proximal end 29 of sleeve 40 may be mounted anywhere such that its position is fixed relative to cylinder 16.

[0018] Referring also to Fig. 3, display 26A includes a graduated cylinder 42 defining an outer radial wall 44 having an open lower end 47 and an upper end that is closed by an upper end wall 46 that is preferably integral with radial wall 44. The lower end is closed by a lower end wall 48 that is defined by a cylindrical body 50 having an outer radial surface 52 that defines a lower horizontal surface 55 and an upper horizontal surface 57. The outer diameter of radial surface 52 is substantially equal to the inner diameter of radial wall 44 to enable end wall 48 to be press fit in the lower end of cylinder 42. A flange 54 extends radially outwardly from the lower surface 55 a distance that is substantially equal to the thickness of radial wall 44 to provide a stop when end wall 48 is inserted into cylinder 42.

[0019] A cylindrical bore 56 extends vertically through the central portion of end wall 48 and has a diameter slightly greater than the diameter of cable member 38. The distal end 31 of sleeve 40 is connected to the lower end 55 of end wall 48 and aligned with bore 56 by threads, press fit, or other suitable means so as to be axially fixed to the wall 48. Fig 3 shows a threaded ferrule 43 which is crimped onto the end of the sleeve 40 (sleeve 40 may be similarly mounted to bracket 34). Cable member 38 extends upwardly from sleeve 40 at the distal end 31 and through bore 56, and is connected to the lower surface 60 of a cylindrical disc that provides indicator 27. Sleeve 40 could alternatively be mounted anywhere such that its position is fixed with respect to disc 27. Disc 27 extends horizontally within cylinder 42, and has a diameter slightly less than the inner diameter of radial wall 44 so that cylinder 42 guides the disc 27 as it moves. A compression coil spring 62 is connected at a first end to upper surface 57 of end wall 48 and extends vertically upwardly through the cylinder 42 such that spring 62 surrounds cable member 38. Spring 62 at its upper end presses against the lower surface 60 of disc 27 and provides a vertical force F that biases disc 27 upwardly.

[0020] At least radial wall 44, and preferably also walls 46 and 48 are transparent and are formed of Plexiglas in accordance with the preferred embodiment. A scale 64 is formed in or printed on radial wall 44 having markings that are aligned with the lower surface 60 of disc 27 such that the scale is read relative to the lower surface 60.

Alternatively, a marking may be present on the outer radial surface of disc 27 that is aligned with the markings in order to facilitate of measurement of scale 64.

[0021] During operation, when load 12 is raised along the direction of Arrow A, proximal, or load, end 29 of cable member 38 is extended relative to the proximal end of outer sleeve 40. Accordingly, the distal, or indicator, end 31 of cable member 38 is "pulled" and translated against spring force F and downwardly relative to the distal end of sleeve 40. Cable member 38 thus moves disc 27 downwardly along the direction of Arrow A a distance equal to the distance that quadrant A of load 12 is lifted. Conversely, when load 12 is lowered along the direction of Arrow B, proximal end 29 of cable member 38 is contracted relative to the proximal end of sleeve 40. Distal end 31 of cable member is thus "pushed" and translated upwardly, thereby moving disc 27 upwardly. Spring force F also biases disc 27 upwardly to remove any potential slack in cable assembly 28. The upward movement of disc is equal to the distance that quadrant A of load 12 is lowered. The position of disc 27 relative to scale 64 thus indicates the position of load 12 at quadrant A.

[0022] A user may therefore manually examine the position of discs 27 for all displays 26A-D to determine the relative positions of quadrants A-D of load 12. The positions of quadrants A-D, in turn, provide an indication of the actual orientation of the load 12. If the actual load orientation does not equal the desired load orientation, the positions of actuators 14A-14D may be adjusted as necessary to achieve the desired load orientation. For example, if disc 27 of display 26A is higher than discs 27 of indicators 26B-26D, the user will determine that quadrant A of load 12 needs to be raised in order to achieve the desired horizontal orientation. If, on the other hand, disc 27 is lower than discs 27 of indicators 26B-26D, the user will determine that quadrant A needs to be lowered in order to achieve the desired orientation.

[0023] While the position of discs 27 is examined relative to discs 27 of the other displays 26 to determine the orientation of load 12 in accordance with the preferred embodiment, it should be appreciated that the scale markings may also provide a measurement of the actual vertical position of load 12 at the given quadrants. Advantageously, the measurement system 10 uses no processors, electronic communications devices, or other costly electronic components, and is easy to install.

[0024] The invention has been described in connection with what are presently considered to be the most practical and preferred embodiments. However, the present invention has been presented by way of illustration and is not intended to be limited to

the disclosed embodiments. For example, while the mechanical linkage 24 includes a cable assembly 28 in accordance with the preferred embodiment, it should be appreciated that alternative linkages are available to place disc 27 in mechanical communication with load 12. For instance, cable assembly 28 could be replaced by a conduit containing a hydraulic fluid that provides a force, in response to movement of the load 12, that biases the disc up and down during operation. Accordingly, those skilled in the art will realize that the invention is intended to encompass all modifications and alternative arrangements included within the spirit and scope of the invention, as set forth by the appended claims.

CLAIMS

I CLAIM:

1. A lift measurement system for determining a position of a load during a lift operation, the system comprising:

at least one housing defining a scale and enclosing a movable indicator that is aligned with the scale; and

a mechanical linkage connected at one end to move with the load and the other end to move with the indicator, whereby movement of the load is translated to movement of the indicator relative to the scale to provide an indication of the position of the load.

2. The system as recited in claim 1, wherein the mechanical linkage further comprises a cable assembly having a proximal end attached to the load and a distal end attached to the indicator.

3. The system as recited in claim 2, wherein the cable assembly defines a proximal end and a distal end, wherein the cable assembly includes a cable member surrounded by an outer sleeve, wherein the proximal end of the cable member is connected to the load, and wherein the proximal end of the outer sleeve is fixed relative to the load.

4. The system as recited in claim 3, wherein the distal end of the cable member is connected to the indicator, and wherein the distal end of the sleeve is fixed relative to the indicator.

5. The system as recited in claim 3, wherein the mechanical linkage further comprises a conduit containing hydraulic fluid.

6. The system as recited in claim 3, wherein the proximal end of the sleeve is fiexed to a hydraulic cylinder which lifts the load.

7. A lift measurement system for determining an orientation of a load during a lift operation, the system comprising:

first and second housings defining corresponding scales and enclosing corresponding indicators that are movable relative to the scale and aligned with the scale; and

first and second mechanical linkages, each having first ends connected to move with the load at first and second locations, and each having second ends in communication with the indicator, whereby movement of the first and second locations is translated to movement of the first and second indicators, respectively, and whereby the relative positions of the first and second indicators provides an indication of the orientation of the load.

ABSTRACT

A lift measurement system is provided for determining a position of a load during a lift operation. The system includes a housing that defines a scale and encloses a movable indicator that moves relative to the scale and is aligned with the scale. A mechanical linkage is in communication with the load and the scale, such that movement of the load is translated to movement of the indicator relative to the scale to provide an indication of the position of the load. A plurality of housings and linkages may be installed at various locations on the load such that the relative position of the corresponding indicators provides feedback related to the orientation of the load.

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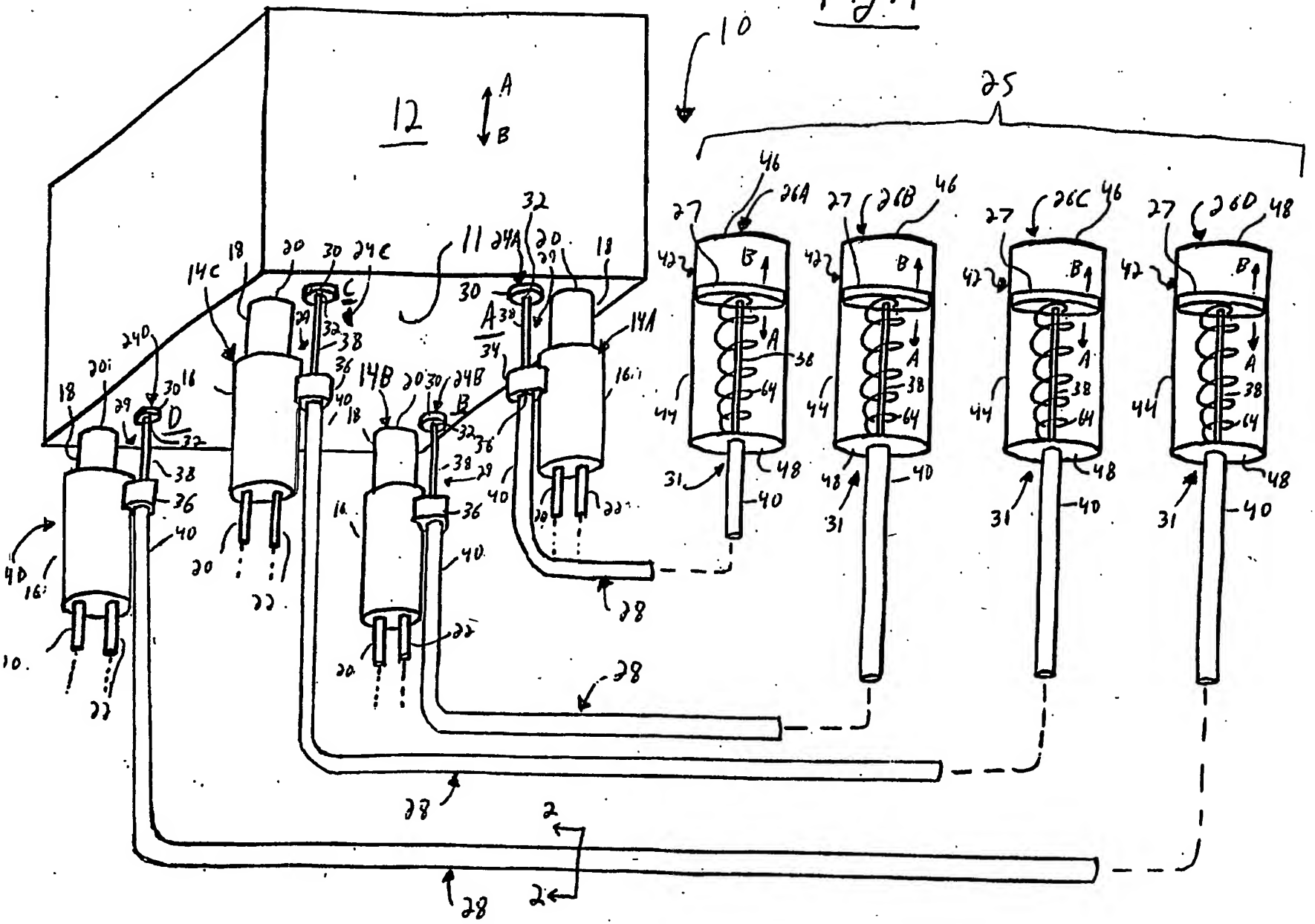
Fig. 1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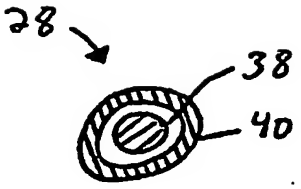
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Fig. 2

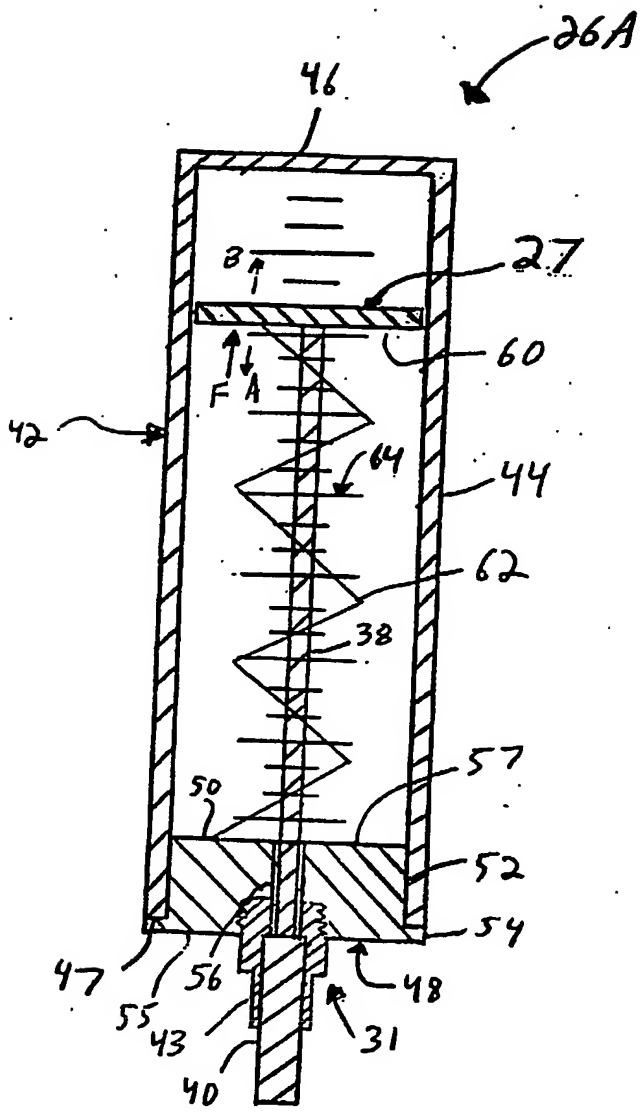
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Fig. 3